



BSI Standards Publication

Steel for the reinforcement of concrete — Weldable reinforcing steel — General

National foreword

This British Standard is the UK implementation of EN 10080:2005.

The UK participation in its preparation was entrusted to Technical Committee ISE/104, Concrete Reinforcing and Pre-Stressing Steels.

A list of organizations represented on this committee can be obtained on request to its committee manager.

EN 10080:2005 was originally referenced in the Official Journal of the European Union (OJEU)'s list of harmonized standards in December 2005, but it was subsequently withdrawn from the list in December 2006.

The UK committee advises users that this standard does not include all the requirements to fully specify reinforcing steels, and that it was intended that EN 10080:2005 should be used in conjunction with a Technical Specification in which the details of the performance characteristics would be specified. In the UK, the following standards were revised for use with EN 10080:2005:

- BS 4449:2005+A3:2016, *Steel for the reinforcement of concrete – Weldable reinforcing steel – Bar, coil and decoiled product – Specification*
- BS 4482:2005, *Steel wire for the reinforcement of concrete products – Specification*
- BS 4483:2005, *Steel fabric for the reinforcement of concrete – Specification*

These standards are complete technical specifications, and the UK committee further advises users that they contain some requirements that supplement those of EN 10080:2005.

Since the status of EN 10080:2005 was changed by its withdrawal from the OJEU's list of harmonized standards, and since it does not fully specify all the requirements for reinforcing steels, the UK committee recommends that users should consult BS 4449:2005+A3:2016, BS 4482:2005 and BS 4483:2005 when applying this standard.

This publication has been prepared under a mandate given to the European Standards Organizations by the European Commission and the European Free Trade Association. It is intended to support requirements of the EU legislation detailed in the European Foreword. A European Annex, usually Annex ZA or ZZ, describes how this publication relates to that EU legislation.

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English version

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Betonstahl - Allgemeines

This European Standard was approved by CEN on 21 April 2005.

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Foreword

This document (EN 10080:2005) has been prepared by Technical Committee ECISS/TC 19 “Concrete reinforcing and pre-stressing steels - Properties, dimensions, tolerances and specific tests”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2005, and conflicting national standards shall be withdrawn at the latest by May 2007.

This document has been prepared under Mandate M/115 given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of the EU Construction Products Directive (89/106/EEC).

For relationship with the EU Construction Products Directive, see informative Annex ZA, which is an integral part of this document.

This document does not apply to non-weldable reinforcing steel.

This document does not define technical classes. Technical classes should be defined in accordance with this document by specified values for R_e , A_{gt} , R_m/R_e , $R_{e,act}/R_{e,nom.}$ (if applicable), fatigue strength (if required), bendability, weldability, bond strength, strength of welded or clamped joints (for welded fabric or lattice girders) and tolerances on dimensions.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

1.1 This European Standard specifies general requirements and definitions for the performance characteristics of weldable reinforcing steel used for the reinforcement of concrete structures, delivered as finished products in the form of:

- bars, coils (rod, wire) and de-coiled products;
- sheets of factory-made machine-welded fabric;
- lattice girders.

1.2 Steels according to this European Standard have a ribbed, indented or smooth surface.

1.3 This European Standard does not apply to:

- non-weldable reinforcing steel;
- galvanized reinforcing steel;
- epoxy-coated reinforcing steel;
- corrosion resistant reinforcing steel;
- prestressing steels (see prEN 10138-1 to -4);
- indented strip;
- further processing, e.g. cutting or cutting and bending.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 10020:2000, *Definition and classification of grades of steel*

EN 10079:1992, *Definition of steel products*

EN ISO 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing (ISO 377:1997)*

EN ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension / compression testing machines — Verification and calibration of the force-measuring system (ISO 7500-1:2004)*

EN ISO 15630-1, *Steel for the reinforcement and prestressing of concrete — Test methods — Part 1: Reinforcing bars, wire rod and wires (ISO 15630-1:2002)*

EN ISO 15630-2, *Steel for the reinforcement and prestressing of concrete — Test methods — Part 2: Welded fabric (ISO 15630-2:2002)*

NOTE See also C.2 and D.2.

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 10020:2000 and EN 10079:1992 and the following apply.

3.1

reinforcing steel

steel product with a circular or practically circular cross-section which is suitable for the reinforcement of concrete

3.2

ribbed reinforcing steel

reinforcing steel with at least two rows of transverse ribs, which are uniformly distributed over the entire length

3.3

longitudinal rib

uniform continuous protrusion parallel to the axis of the bar, rod or wire

3.4

transverse rib

any rib on the surface of the bar, rod or wire other than a longitudinal rib

3.5

rib height, h

distance from the highest point of the rib (transverse or longitudinal) to the surface of the core, to be measured normal to the axis of the bar, rod or wire

3.6

rib or indentation spacing, c

distance between the centres of two consecutive transverse ribs or two consecutive indentations measured parallel to the axis of the bar, rod or wire

3.7

angle of transverse rib or indentation inclination, β

angle between the axis of the transverse rib or indentation and the longitudinal axis of the bar, rod or wire

3.8

transverse rib flank inclination, α

angle of the rib flank measured perpendicular to the longitudinal axis of the rib

3.9

relative rib area, f_R

area of the projection of all ribs on a plane perpendicular to the longitudinal axis of the bar, rod or wire, divided by the rib spacing and the nominal circumference

3.10

indented reinforcing steel

reinforcing steel with defined indentations uniformly distributed over the entire length

3.11

indentation depth, t

distance between the surface of the wire and the deepest point of the indentation

3.12

indentation width, b

width of the indentation to be measured parallel to the axis of the bar, rod or wire

3.13

plain reinforcing steel

reinforcing steel with a smooth surface

3.14

coil

single length of reinforcing steel (usually rod or wire) wound in concentric rings

3.15

de-coiled product

reinforcing steel manufactured in coils and subsequently straightened for further processing

3.16

nominal cross-sectional area, A_n

cross-sectional area equivalent to the area of a circular plain bar of the same nominal diameter, d (i.e. $\frac{\pi d^2}{4}$)

3.17

welded fabric

arrangement of longitudinal and transverse bars, rods or wires of the same or different nominal diameter and length that are arranged substantially at right angles to each other and factory electrical resistance welded together by automatic machines at all points of intersection

3.18

lattice girder

two or three-dimensional metallic structure comprising an upper chord, one or more lower chords and continuous or discontinuous diagonals which are welded or mechanically assembled to the chords

3.19

characteristic value

value of a material or product property having a prescribed probability of not being attained in a hypothetical unlimited test series

NOTE This value generally corresponds to a specific fractile of the assumed statistical distribution of the particular property of the material or product.

3.20

minimum value

value below which no test result shall fall

3.21

maximum value

value which no test result shall exceed

3.22

batch

quantity of bars, rods, wires or decoiled products of one nominal diameter and one cast either in coils or bars or any quantity of welded fabric or lattice girders of one type produced by one manufacturer and presented for examination at any one time

3.23

factory production control

permanent internal control of production performed by the manufacturer

3.24

semi-finished product

product which requires further processing in order to achieve the standard and special properties specified in this document for reinforcing steels

3.25

standard property

property which is contained in this document as part of the factory production control requirements for every test unit

3.26**special property**

property contained in this document which is not determined as part of the factory production control requirements for every test unit

3.27**standard welded fabric**

welded fabric manufactured according to specified delivery conditions and available from stock

3.28**purpose made welded fabric**

welded fabric manufactured according to user's specific requirements

3.29**longitudinal wire**

reinforcing steel in the manufacturing direction of the welded fabric

3.30**transverse wire**

reinforcing steel perpendicular to the manufacturing direction of the welded fabric

3.31**twin wires**

two wires of the same technical class and nominal diameter placed adjacent to each other as a pair in welded fabrics

3.32**pitch of welded fabric**

centre-to-centre distance of wires in a sheet of welded fabric

NOTE For twin wire fabric the pitch is measured between the tangents of the adjacent wires.

3.33**overhang of welded fabric, u_1 , u_2 , u_3 , u_4**

length of longitudinal or transverse wires projecting beyond the centre of the outer crossing wire in a sheet of welded fabric

NOTE For twin wire welded fabric the overhang is measured from the tangent line of the adjacent wires.

3.34**length of a welded fabric sheet, L**

dimension of the longest side of a sheet of welded fabric, irrespective of the manufacturing direction

3.35**width of a welded fabric sheet, B**

dimension of the shortest side of the sheet of welded fabric, irrespective of the manufacturing direction

3.36**standard lattice girder**

lattice girder manufactured according to specified delivery conditions and available from stock

3.37**purpose made lattice girder**

lattice girder manufactured according to user's specific requirements

3.38**lower chord**

set of longitudinal reinforcing steels placed in the lower part of a lattice girder

NOTE The constituent longitudinal reinforcing steels of the lower chord can be interlinked or not.

3.39

upper chord

longitudinal reinforcement placed in the upper part of a lattice girder, of which the base steel is either a reinforcing steel or a steel strip

3.40

diagonals

reinforcing steels linking the upper and lower chord of a lattice girder

NOTE They form harmonic curves in the case of continuous diagonals or are independent elements in the case of discontinuous diagonals.

3.41

lattice girder length, L

overall length of a lattice girder

3.42

design height of a lattice girder, H_1

distance between the lowest point of the lower chord and the highest point of the upper chord

3.43

overall height of a lattice girder, H_2

distance between the lowest point and the highest point of a lattice girder

3.44

lattice girder overhang, u_1, u_2

length of the diagonals beyond either the upper chord (u_1) or the lower chord (u_2)

3.45

design width of a lattice girder, B_1

distance between the outlying points of the lower chords

3.46

overall width of a lattice girder, B_2

distance between the outlying points of a lattice girder

3.47

pitch of diagonals, P_s

distance between equivalent consecutive junction points of the diagonals with the chords

3.48

angle of inclination of diagonals, ϑ

angle between the axis of a diagonal and the longitudinal axis of a lattice girder in the plane of the diagonal in the middle of the height of a lattice girder

3.49

technical class

type of reinforcing steel defined by its performance characteristics, identified by a unique product number

3.50

reinforcing steel grade

steel grade defined by its characteristic yield strength and ductility requirements

4 Symbols

Symbols used in this European Standard are listed in Table 1.

NOTE For comparison of symbols used in this European Standard with those used in EN 1992-1-1 and EN 1992-1-2 (see Annex E).

Table 1 — List of symbols

Symbol	Description	Unit
A_n	Nominal cross-sectional area	mm ²
A_{qt}	Percentage total elongation at maximum force	%
b	Width of indentation	mm
c	Transverse rib or indentation spacing	mm
C_{eq}	Carbon equivalent value (CEV)	% by mass
C_v	Specified characteristic value	^a
d	Nominal diameter of the reinforcing steel	mm
e	Gap between rib or indentation rows	mm
f_R	Relative rib area	-
f_P	Relative indentation area	-
h	Rib height	mm
k	Coefficient as a function of the number of test results	-
$\bar{x}$	Average value of test results	^a
R_e	Yield strength	MPa ^b
R_{eH}	Upper yield strength	MPa ^b
R_m	Tensile strength	MPa ^b
R_m/R_e	Ratio tensile strength/yield strength	-
$R_{p0.2}$	0.2 % proof strength, non proportional extension	MPa ^b
s	Estimate of the standard deviation	^a
α	Transverse rib flank inclination	°
β	Angle of transverse rib or indentation inclination	°
$2\sigma_a$	Stress range in the axial load fatigue test	MPa ^b
σ_{max}	Specified maximum stress in the fatigue test	MPa ^b
B	Length of transverse wire in welded fabric	mm
d_C	Diameter of transverse wires in welded fabric	mm
d_L	Diameter of longitudinal wires in welded fabric	mm
L	Length of longitudinal wire in welded fabric, or length of lattice girder	mm
N_C	Number of transverse wires in welded fabric	-
N_L	Number of longitudinal wires in welded fabric	-
P_C	Pitch of transverse wires in welded fabric	mm
P_L	Pitch of longitudinal wires in welded fabric	mm
F_s	Shear force of welded connections in welded fabric	kN
$R_{e,act}$	Actual value of yield strength	MPa ^b
$R_{e,nom}$	Specified value of yield strength	MPa ^b
$R_{e,act}/R_{e,nom}$	Ratio actual value of yield strength / specified value of yield strength	-
a_1, a_2, a_3, a_4	Increment (specified in the product specification)	^a
u_1, u_2	Overhang of the longitudinal wires in welded fabric or length of the diagonals beyond the upper or lower chord of a lattice girder	mm
u_3, u_4	Overhang of the transverse wires in welded fabric	mm
A_{Ch}	Cross-sectional area of chord	mm ²
A_{Di}	Cross-sectional area of diagonal	mm ²
B_1	Design width of lattice girder	mm
B_2	Overall width of lattice girder	mm
F_d	Shear force of a clamped joint in lattice girder	kN
F_w	Shear force of a single weld in lattice girder	kN
H_1	Design height of lattice girder	mm
H_2	Overall height of lattice girder	mm
P_s	Pitch of diagonals of lattice girder	mm
$R_{e,Ch}$	Yield strength of the chord in lattice girder	MPa ^b
$R_{e,Di}$	Yield strength of the diagonal in lattice girder	MPa ^b
t	Depth of indentation	mm
t_s	Thickness of metal strip in lattice girder	mm
ϑ	Inclination of the diagonals in lattice girder	°

(to be continued)

Table 1 — List of symbols (*concluded*)

Symbol	Description	Unit
b	Width of the beam (beam test)	mm
d_m	Bend diameter (beam test)	mm
F_a	Total force applied (beam test)	kN
F_a	Tension force (pull-out test)	kN
f_c	Average of concrete strength (pull-out test)	MPa ^b
f_{cm}	Target value of the concrete strength class (pull-out test)	MPa ^b
F_i	Force in hinge and bar or wire (beam test)	kN
v_p	Loading rate (pull-out test)	N/s
Δ_o	Slip (pull-out test)	mm
σ_s	Stress in the bar or wire (beam test)	MPa ^b
τ_b	Bond stress (beam test)	MPa ^b
τ_{bu}	Bond stress at maximum force (beam test)	MPa ^b
τ_{dm}	Bond stress (pull-out test)	MPa ^b
$\tau_{0,01}, \tau_{0,1}, \tau_1$	Bond stress at 0,01 mm, 0,1 mm and 1 mm slip (beam test)	MPa ^b
^a The unit depends on the property.		
^b 1 MPa = 1 N/mm ² .		

5 Designation

5.1 Bar, coil and de-coiled product

The products covered by this European Standard shall be designated with the following information:

- a) description of the product form (i.e. bar, coil, de-coiled product);
- b) number of this European Standard;
- c) nominal dimensions of the product;
- d) technical class.

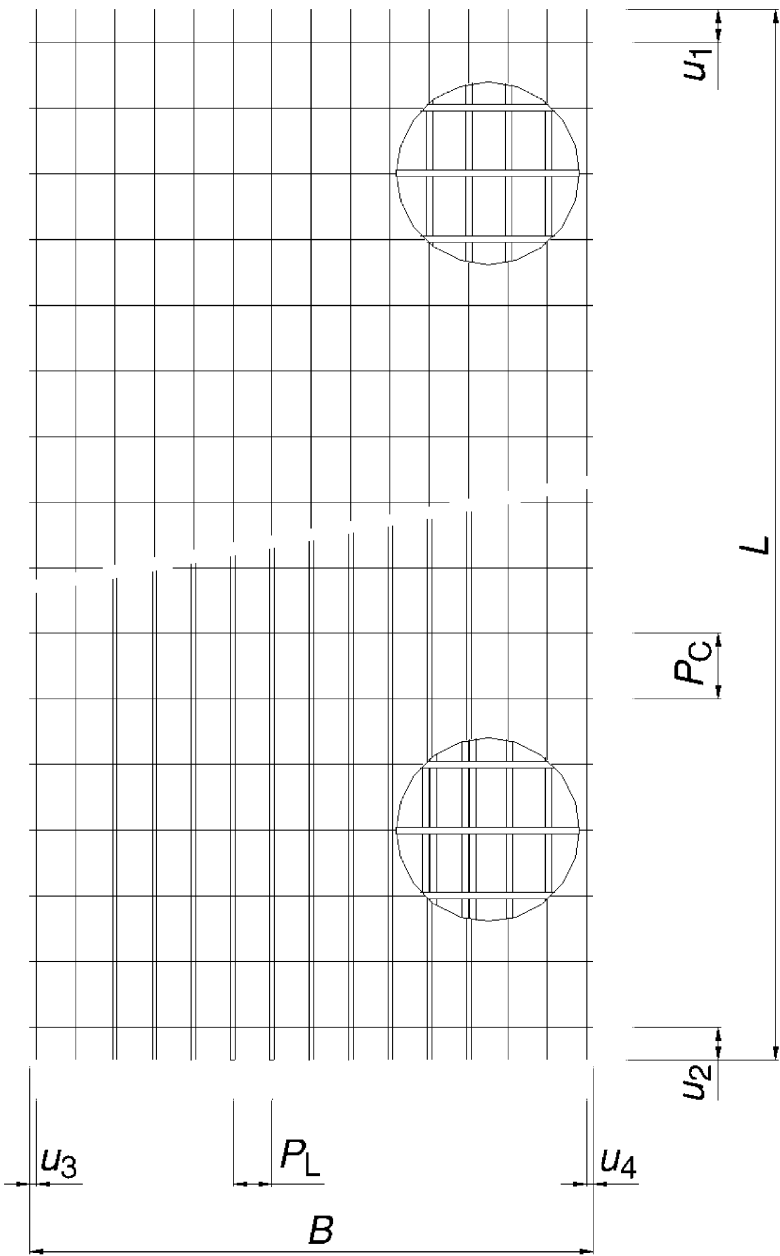
5.2 Welded fabric

Welded fabric shall be designated with the following information:

- a) designation of the product form (welded fabric);
- b) number of this European Standard;
- c) nominal dimensions of the product (dimensions of the wires, dimensions of the sheet, pitch of wires, overhangs);
- d) technical class(es) of the steel(s).

NOTE 1 Brief designations are widely used to describe standard welded fabric. The relevant mesh arrangement can be seen from the tabulated data issued by the manufacturer.

NOTE 2 Purpose made welded fabric can be described using the indications given in Figure 1, or by a fully dimensioned drawing, and should be identified by the user's reference.



Key

- N_L number of longitudinal wires
- P_L pitch of longitudinal wires
- d_L diameter of longitudinal wires
- N_C number of transverse wires
- P_C pitch of transverse wires
- d_C diameter of transverse wires
- L length of longitudinal wire
- B length of transverse wire
- u_1 overhang of the longitudinal wires
- u_2 overhang of the longitudinal wires
- u_3 overhang of the transverse wires
- u_4 overhang of the transverse wires

Figure 1 — Geometrical characteristics of purpose made welded fabric

5.3 Lattice girders

Lattice girders (see Figure 2) shall be designated with the following information:

- a) designation of the product form, and/or product name (lattice girder);
- b) number of this European Standard;
- c) design height of the lattice girder;
- d) nominal dimensions of the upper chord, diagonal and lower chord;
- e) technical class(es) of the steel(s) for the upper chord, diagonal and lower chord.

NOTE Lattice girders can be described using the indications given in Figure 2, or by a fully dimensioned drawing and should be identified by the user's reference.

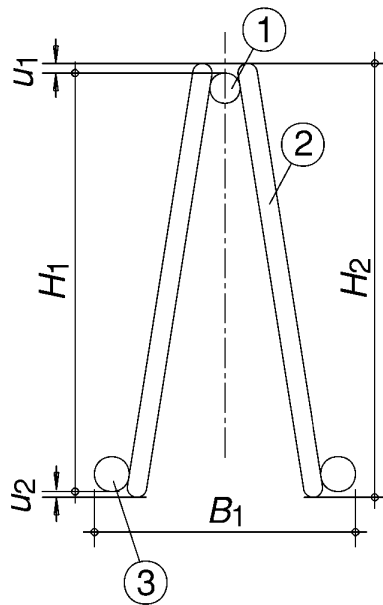


Figure 2a)

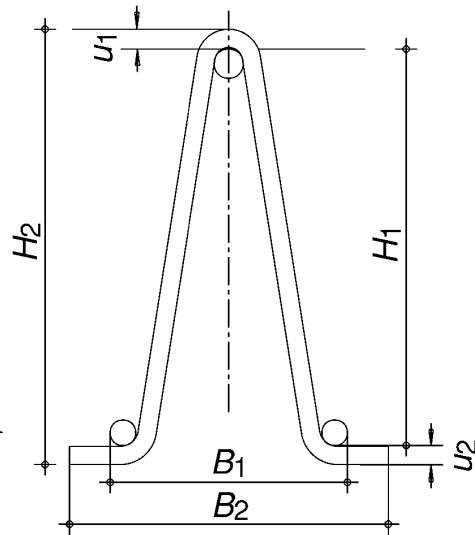


Figure 2b)

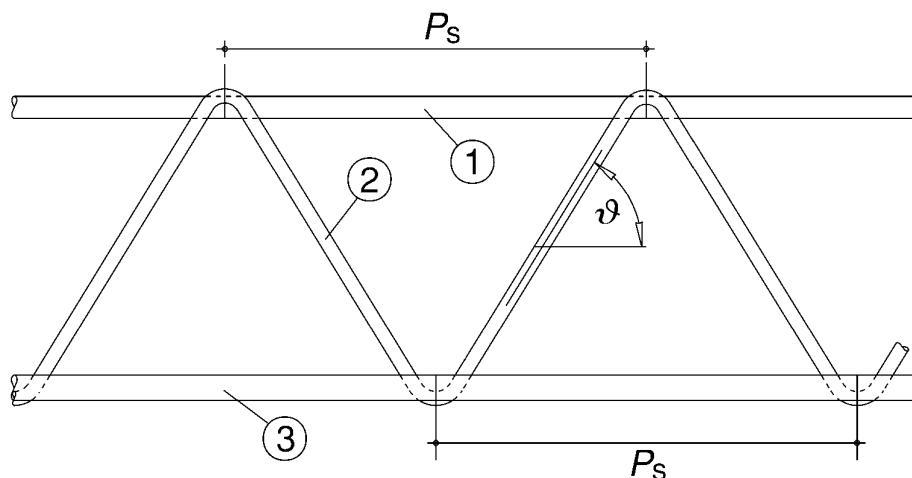


Figure 2c)

Key

- 1 upper chord
- 2 diagonal
- 3 lower chord

Figure 2 — Height (H_1 , H_2), width (B_1 , B_2), overhang (u_1 , u_2) and pitch of diagonals (P_s) of a lattice girder

6 Steelmaking and manufacturing processes

- 6.1** The melting process and type of de-oxidation of the steel is at the discretion of the steel producer.
- 6.2** The manufacturing process for the production of coils and bars is at the discretion of the manufacturer. It shall be reported to the purchaser if requested.
- 6.3** De-coiling of coil material shall be done by a machine made for this purpose.
- 6.4** The manufacture of reinforcing steel by re-rolling finished products (e.g. sheets or rails) is not permitted.
- 6.5** All welded fabric shall be factory made and machine welded. The joints, at the intersection of the longitudinal wires and the transverse wires, shall be made by electrical resistance welding, to provide a specified shear resistance.

Welded fabric may be composed of a different technical class in each direction.

Twin wire welded fabric shall be composed of twin wires in only one direction.

- 6.6** All lattice girders shall be factory made, and may be made from bars and coils or strip (for upper chords only). The joints between chords and diagonals shall be made by electrical resistance welding, or by mechanical clamping, to provide a specified shear resistance.

7 Performance characteristics

7.1 Weldability and chemical composition

- 7.1.1** Weldability is determined by two characteristics:

— carbon equivalent;

— limitations on the content of certain elements.

7.1.2 The maximum values of individual elements and the carbon equivalent shall not exceed the values given in Table 2.

7.1.3 The carbon equivalent value C_{eq} shall be calculated using the following formula:

$$C_{eq} = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15 \quad (1)$$

Where

the symbols of the chemical elements indicate their content in % by mass.

NOTE For guidance on welding of reinforcing steels see prEN ISO 17660.

Table 2 — Chemical composition (% by mass)

	Carbon ^a	Sulphur	Phosphorus	Nitrogen ^b	Copper	Carbon equivalent value ^a
	max.	max.	max.	max.	max.	max.
Cast analysis	0,22	0,050	0,050	0,012	0,80	0,50
Product analysis	0,24	0,055	0,055	0,014	0,85	0,52
^a It is permitted to exceed the maximum values for carbon by 0,03 % by mass, provided that the carbon equivalent value is decreased by 0,02 % by mass.						
^b Higher nitrogen contents are permissible if sufficient quantities of nitrogen binding elements are present.						

7.1.4 Durability of products according to this European Standard is provided by the chemical composition specified in Table 2.

7.2 Mechanical properties

7.2.1 General

In the context of this European Standard the characteristic value is (unless otherwise indicated) the lower or upper limit of the statistical tolerance interval at which there is a 90 % probability ($1 - \alpha = 0,90$) that 95 % ($p = 0,95$) or 90 % ($p = 0,90$) of the values are at or above this lower limit, or are at or below this upper limit respectively (see Table 16 and Table 17). This definition refers to the long term quality level of production.

7.2.2 Conditions of testing

The conditions of testing shall be as specified in Table 3.

Table 3 — Conditions of testing the mechanical properties

Manufacturing and delivery conditions of the product	Conditions of testing (test pieces)
Produced in straight lengths by hot rolling	As delivered ^a or aged ^b
Produced in straight lengths by cold working	Aged ^b
Produced as coil and delivered de-coiled	Aged ^b
Produced and delivered as coil	Straightened and aged ^b
Welded fabric	Aged ^{a, b, c}
Lattice girders	Aged ^{a, b, c}
^a Aged in the case of dispute. ^b Aged means: Heating of the test piece to 100 °C, maintaining at this temperature ± 10 °C for a period of 1 h + $\frac{15}{0}$ min and then cooling in still air to room temperature. The method of heating is left to the discretion of the manufacturer. ^c Or as delivered when the constituents are produced in straight lengths by hot rolling.	

7.2.3 Tensile properties

7.2.3.1 The specified values for the tensile properties (R_e , R_m/R_e , A_{gt} , and where relevant $R_{e,act}/R_{e,nom.}$) shall be the corresponding specified characteristic value with $p = 0,95$ for R_e , and $p = 0,90$ for A_{gt} , R_m/R_e , and $R_{e,act}/R_{e,nom.}$.

7.2.3.2 The values R_e and R_m shall be calculated using the nominal cross-sectional area of the product.

7.2.3.3 For yield strength (R_e) the upper yield strength (R_{eH}) shall apply. If a yield phenomenon is not present, the 0,2 % proof strength ($R_{p0,2}$) shall be determined.

7.2.4 Shear force of welded or clamped joints

7.2.4.1 Welded fabric

The specified value of the shear force of welded joints in welded fabric, F_s , shall be a minimum value. The specified minimum value of F_s shall not be less than $0,25 \times R_e \times A_n$, where R_e is the specified characteristic yield strength, and A_n is the nominal cross-sectional area of either:

- the larger wire at the joint in a single wire welded fabric,
- one of the twin wires in a twin wire welded fabric (twin wires in one direction).

7.2.4.2 Lattice girders

7.2.4.2.1 Welded joints

The specified value for the shear force of a weld point in a lattice girder, F_w , shall be a minimum value. The specified minimum value of F_w shall not be less than

$$F_w \geq 0,25 \times R_{e,Ch} \times A_{Ch} \quad (2)$$

or

$$F_w \geq 0,6 \times R_{e,Di} \times A_{Di} \quad (3)$$

whichever is the lower.

For the evaluation of the test result for the shear force it is necessary to record how many weld points have been loaded and failed in the same moment.

NOTE Annex A gives examples of weld points in a joint.

7.2.4.2.2 Clamped joints

Clamped joints are only used for joining the lower chord and the diagonals. The specified value for the shear force of a clamped joint in lattice girders, F_d , shall be a minimum value. The specified minimum value of F_d shall not be less than

$$F_d \geq 0,25 \times R_{e,Di} \times A_{Di} \quad (4)$$

7.2.5 Fatigue strength

If submitted to axial force controlled fatigue testing in the fluctuating tension range, the product shall withstand the specified number(s) of stress cycles. The stress shall vary sinusoidally, over the specified range of stress $2\sigma_a$, from the specified σ_{max} .

NOTE $2\sigma_a$ and σ_{max} should be expressed on the basis of the nominal cross-sectional area of the bar, rod or wire.

7.2.6 Suitability for bending

7.2.6.1 Suitability for bending shall be determined by the bend and/or rebend test.

7.2.6.2 The bend test, if required, shall be performed according to EN ISO 15630-1, with a minimum angle of bend of 180° .

After testing the products shall show neither rupture nor cracks visible to a person of normal or corrected vision. The mandrel diameter specified for the bend test shall not exceed the relevant maximum diameter specified in Table 4.

Table 4 — Mandrel diameter for the bend test

Nominal diameter d mm	Mandrel diameter max.
≤ 16	$3 d$
> 16	$6 d$

7.2.6.3 The re-bend test, if required, shall be performed according to EN ISO 15630-1.

Test pieces shall be bent through a minimum angle of 90° around a mandrel having a diameter not exceeding the relevant maximum diameter specified in Table 5, aged and then bent back by at least 20° .

After the test the specimen shall show no sign of fracture or cracks visible to a person of normal or corrected vision.

Table 5 — Mandrel diameter for the re-bend test

Nominal diameter d mm	Mandrel diameter max.
≤ 16	$5 d$
$> 16 \leq 25$	$8 d$
> 25	$10 d$

7.3 Dimensions, mass and tolerances

7.3.1 Diameters, cross-sectional area

The nominal diameters up to and including 10,0 mm shall be in half millimetres, and above 10,0 mm, shall be in whole millimetres.

Preferred nominal diameters, cross-sectional areas and masses per metre are given in Table 6.

7.3.2 Mass per metre and tolerances

The values for the nominal mass per metre (see Table 6) are calculated from the values of the nominal cross-sectional area using a density value of 7,85 kg/dm³.

The permissible deviation from the nominal mass per metre shall not be more than $\pm 4,5\%$ on nominal diameters above 8,0 mm, and $\pm 6,0\%$ on nominal diameters 8,0 mm and below.

7.3.3 Length of bars

7.3.3.1 The nominal length of bars shall be agreed at the time of enquiry and order.

7.3.3.2 The permissible deviation from the nominal length shall be agreed at the time of enquiry and order.

7.3.4 Coil mass

The nominal coil mass shall be agreed at the time of enquiry and order.

7.3.5 Dimensions of welded fabric

7.3.5.1 Wire arrangement

7.3.5.1.1 General

The wires of a sheet shall be single wires and / or twin wires.

7.3.5.1.2 Relative diameters of wires

7.3.5.1.2.1 For single wire fabric, the nominal diameters of wires shall meet the following requirement

$$d_{\min.} \geq 0,6 d_{\max.} \quad (5)$$

where

$d_{\max.}$ is the nominal diameter of the thickest wire,

$d_{\min.}$ is the nominal diameter of the crossing wire.

Other requirements may be agreed at the time of enquiry and order.

7.3.5.1.2.2 For welded fabric with twin wires in one direction, the nominal diameters of the wires shall meet the following requirement

$$0,7 d_s \leq d_T \leq 1,25 d_s \quad (6)$$

where

d_s is the nominal diameter of the single wires,

d_T is the nominal diameter of the twin wires.

Other requirements may be agreed at the time of enquiry and order.

7.3.5.1.3 Preferred pitch and overhang

The pitch of longitudinal wires and transverse wires shall not be less than 50 mm.

NOTE The overhang should not be less than 25 mm.

7.3.5.2 Dimensions and tolerances on dimensions

The nominal length, width, pitch and overhangs of welded fabric shall be agreed at the time of enquiry and order.

The permitted deviations for welded fabric are:

Length and width of the welded fabric:	± 25 mm or $\pm 0,5$ % whichever is greater;
wire pitch:	± 15 mm or $\pm 7,5$ % whichever is greater;
overhangs:	to be agreed at the time of enquiry and order.

Special tolerance requirements may be agreed between the manufacturer and the purchaser.

7.3.6 Dimensions of lattice girders

7.3.6.1 Configurations

Where wires are welded together, they shall meet the requirement that $d_{\min.} / d_{\max.}$ is greater than 0,3.

If metal strips are welded to wires, the following limitation shall apply:

$$t_s \geq 0,15 d \quad (7)$$

where

d is the nominal diameter of the diagonal,

t_s is the thickness of the metal strip.

7.3.6.2 Dimensions and tolerances on dimensions

The nominal length, height, width and pitch of lattice girders shall be agreed at the time of enquiry and order.

Maximum manufacturing tolerances shall be as follows:

length (L)	: ± 40 mm if $L \leq 5,0$ m; : $\pm 0,8$ %, if $L > 5,0$ m;
height (H_1, H_2)	: ${}^{+1}_{-3}$ mm;
width (B_1, B_2)	: $\pm 7,5$ mm;
pitch (P_s)	: $\pm 2,5$ mm;

maximum overhang: may be agreed at the time of enquiry and order.

Table 6 — Preferred nominal diameters, cross-sectional areas and masses per metre

Nominal diameter mm	Bars	Coils and De-coiled products	Welded fabric	Lattice girders	Nominal cross sectional area mm ²	Nominal mass per metre kg/m
4,0		X		X	12,6	0,099
4,5		X		X	15,9	0,125
5,0		X	X	X	19,6	0,154
5,5		X	X	X	23,8	0,187
6,0	X	X	X	X	28,3	0,222
6,5		X	X	X	33,2	0,260
7,0		X	X	X	38,5	0,302
7,5		X	X	X	44,2	0,347
8,0	X	X	X	X	50,3	0,395
8,5		X	X	X	56,7	0,445
9,0		X	X	X	63,6	0,499
9,5		X	X	X	70,9	0,556
10,0	X	X	X	X	78,5	0,617
11,0		X	X	X	95,0	0,746
12,0	X	X	X	X	113	0,888
14,0	X	X	X	X	154	1,21
16,0	X	X	X	X	201	1,58
20,0	X				314	2,47
25,0	X				491	3,85
28,0	X				616	4,83
32,0	X				804	6,31
40,0	X				1257	9,86
50,0	X				1963	15,4